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Case Report

Detection of Pericardial Defect During Lung Cancer Surgery with Proposal for Reconstruction

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Abstract

We report a rare case of pericardial defect detected during lung cancer resection. A 60-year-old male patient presented with a mixed ground-glass nodule about 17 mm in diameter at the left S6b area. During a left lower lobectomy, naked atrium was observed. The operation was completed without any reconstruction, and the patient survived without recurrence or complications two year after surgery. Pathologically, the tumor was lepidic adenocarcinoma of surgical stage IA2 with pT1bN0M0. To date, 13 lung cancers with pericardial deficiency have been reported in Japan. Reconstruction should be considered in the following cases: in pneumonectomy cases after detaching adhesion between the lung and heart, cases in which poor expansion of the remaining lobes after lobectomy is insufficient to sustain the heart, or cases with a defect around the apex. Because pericardial defect is not detected preoperatively, thoracic surgeons should be aware of this congenital disease and indications for the reconstruction.

Keywords: Lung cancer; Operative indication; Pericardial defect; Pericardium; Thoracic surgery

Introduction

Pericardial defects are usually asymptomatic and generally are detected by chance during thoracic surgery. Although this defect is rarely accompanied by lung cancer, the combined cases are predicted to increase with increasing lung cancer surgery. Pericardial defect combined with lung cancer was not detected preoperatively. Therefore, thoracic surgeons should be aware of this congenital disease and indications for reconstruction of the pericardial defect.

Case Report

A 60-year-old Japanese male patient presented with an abnormal shadow on his chest X-ray during an annual checkup. The patient had no past-history and an unremarkable family history. He had no smoking habit. His chest X-ray showed an ill-defined nodule of approximately 20 mm in diameter on the left middle lung (Figure 1a). Chest Computed Tomography (CT) showed a mixed Ground-Glass Nodule (GGN) about 17 mm in diameter at the left S6b area.

Blood tests including tumor markers (CEA, Cyfla, and proGRP), hemogram, and renal and hepatic function enzymes were within normal ranges. His pulmonary function test was normal. Adenocarcinoma was detected by transbronchial lung biopsy. Non-treated atrial fibrillation was present on electrocardiography, but no abnormal findings were found by cardiac ultrasonography. Anti-coagulant therapy was performed.

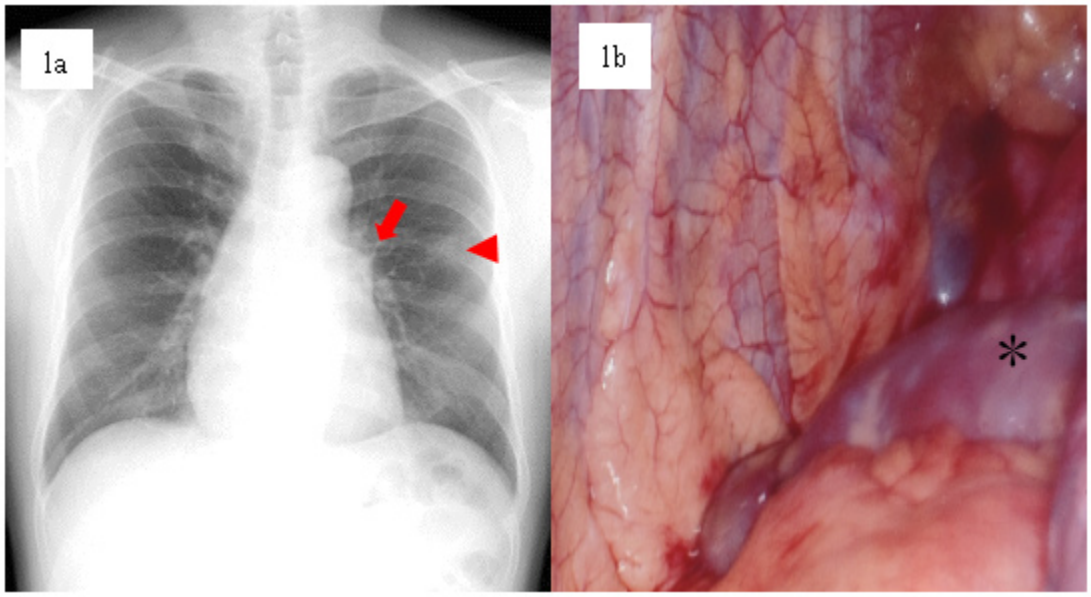

Figure 1: Chest X-ray shows a bulge of the left upper heart border (arrow) and ground-glass nodule (GGN; arrowhead). Naked atrium was observed during surgery (asterisk).

A left lower lobectomy was planned after diagnosis of cT1bN0M0, stage IA2. The operation was performed under thoracoscopy support with a mini thoracotomy, and dissection of the mediastinal lymph nodes was performed. During lymph node dissection, naked atrium was observed and diagnosed as partial pericardial defect. Surgery was completed without any reconstruction because re-expansion of the remaining left upper lobe was satisfactory. The postoperative course was uneventful. Atrial fibrillation continued after operation. The patient was discharged 8 post-operative days. The patient survived without recurrence or any complications as of two years after the operation. Pathologically, the tumor was 23 × 22 × 18 mm (solid size 13 × 8 mm) and was lepidic adenocarcinoma without lymph node metastases or pleural involvement. The surgical stage was pathologically confirmed to be IA2 with pT1bN0M0.

Discussion

Pericardial defect is a rare, congenital condition in which part or all of the pericardium is missing. It may occur due to early degeneration of the ducts of Cuvier and consecutive stunting of the pleuro-pericardium. Van Son and colleagues [1] reported 15 peritoneal deficiencies out of 34,000 cardiac surgery patients (0.044%). South worth and Stevenson [2] found only one case among 14,000 autopsies (0.007%). Saint-Pierre and colleagues [3] described 70% as left sided and only 4% right sided. Complete bilateral absence of pericardium accounted for 9%, and absence of the diaphragmatic part of the pericardium comprised 17%. Because the right side of the duct of Cuvier normally develops into the superior vena cava, this right-left difference therefore is understandable. Pericardial defect occurred three times more frequently in male patients than in female patients.

Pericardial defect associated with lung cancer is extremely rare. However, increases in lung cancer may lead to more serendipitous discoveries of this disease. Only 13 lung cancer cases associated with pericardial defect have been reported in Japan to date, including the case reported herein (Table 1). Excluding one case with unknown details, all but one of the remaining 12 cases were male patients with an age distribution of 44 to 78 years old. All patients had left side pericardial defects with left sided lung cancers. Seven of these cases were complete defect, and five were partial defect cases. It remains difficult to diagnose this condition preoperatively.

	Report	Author	Gender	Age	Op	defect	closure	note
1	1984	Kou	M	44	LUL	Complete		af, AF
2	1989	Tsukada	M	55	LUL	Complete		
3	1999	Fukuya	F	52	LUL	Complete		
4	2000	Hanaoka	M	70	LUL	Complete		
5	2001	Yamaguchi	M	74	LUL	Complete	+	Cardiac displacement
6	2002	Saishoji	?	?	?	?		
7	2003	Ohuchi	M	74	LLL	Partial	+	
8	2011	Shimada	M	61	LP	Complete		
9	2012	Hashimoto	M	58	LUL	Partial	+	
10	2014	Nakatsuka	M	78	LLL	Complete		
11	2016	Murakami	M	50s	LLL	Partial		
12	2016	Shiina	M	60s	LUL	Partial		
13	2018	Miura	M	60	LUL	Partial		af

Table 1: Lung cancers associated with pericardial deficiency in Japan.

Our patient had a bulge in the left upper heart border (Figure 1a), which, in retrospect, represents a bulging left atrium. However, even echocardiography and chest CT were unable to detect the pericardial deficiency of our patient in careful examination after the operation. Although the utility of magnetic resonance imaging (MRI) has been noted for this disease [4], MRI is not and need not become routine for preoperative examination of lung cancer. Some reports suggest cardiac desorption or sudden death due to cardiac incarceration. Kamata and colleagues [5] reported 28 congenital pericardial defects found during general thoracic surgery. Among these, complications were observed in nine patients. Two cases of cardiac arrest and one case of angina may relate to pericardial defects. One case of cardiac arrest occurred during a procedure around the pulmonary hilum that suggested neurogenic reflex, and the other case of cardiac arrest occurred at the position change after surgery and was explained due to poor re-expansion of the remaining left lower lobe after the left upper lobectomy. However, other complications such as arrythmia, phrenic nerve palsy, atelectasis, and emphysema were also observed in cases without pericardial defects. Only six patients received pericardial reconstruction; two were due to cardiac arrest upon position change and cardiac herniation during surgery. The other four were due to prevention of herniation. Among the 12 combined lung cancer and pericardial defect cases in Japan, defects were reconstructed in only three cases. Surprisingly, cardiac displacement occurred in one of the reconstructed cases, and the other cases passed uneventfully. Gassner and his colleagues [4] reported the importance of detecting apical defects quickly because the time from the onset of symptoms of apical herniation and strangulation of the left ventricle to death is too short for intervention. According to those previous reports, the indication for reconstruction of the pericardium must be considered. In cases with complete pericardial defect, reconstruction of pericardium is unnecessary in principle. If pneumonectomy cases after detaching adhesions between lung and heart, or the cases in which poor expansion of the remaining lobes after lobectomy is insufficient to sustain the heart, reconstruction should be considered. In cases with partial pericardial defects, reconstruction of the pericardium is also unnecessary in principle if the defect is too large or too small to strangle the ventricle or atrium. If the remaining lung re-expands enough to sustain the heart and the ventricle is covered with pericardium (partial pericardial defect at the atrium), reconstruction of the pericardium is not necessary concerning compression to the heart. In cases with defect around the apex, reconstruction should be considered.

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